SC OFFICE OF GENERAL SERVICES

CONFINED SPACE PROGRAM

November 17, 1998

I. **GENERAL INFORMATION**: Confined spaces which have immediate health or safety risks require controlled access through a permit program. Being able to recognize and plan for a proper entry into a confined space can mean preventing an unnecessary injury or fatality. Confined space accidents are completely preventable. When workers are properly trained, adequate supervision given, atmospheric testing conducted and safety equipment provided, confined space entry can be a safe working procedure.

A. According to the National Institute for Occupational Safety and Health (NIOSH) which studied confined space accidents, repair/maintenance was the most common reason and rescue was the second most common reason for entering a confined space. 60 percent of confined space fatalities occurred not to the initial entrant/victim but rather from untrained and unprotected standby personnel or would-be volunteers who attempted to rescue the incapacitated entrants. Hazardous atmospheres (oxygen-deficient, toxic or flammable) were involved in 80 percent of the incidents. Additionally, only 6 percent of the victims had received specific confined space entry safety training, and none of the victims' employers used a confined space entry permit system.

B. The standards on confined spaces under the Occupational Safety and Health Act (OSHA) were implemented April 15, 1993, to save over 10,700 injuries and 54 lives nationally each year. These standards have been adopted by the state of South Carolina and apply to the confined spaces located in various facilities owned, operated and/or maintained by the Office of General Services (OGS). The original Confined Space program was distributed in July 1994, revised in November 1996, and is superseded by this document.

C. In order to comply with Title 29 Code of Federal Regulations (29 CFR) 1910.146 and 1926.21, the OGS Confined Space Program will enable OGS employees to recognize potential confined spaces, to understand the hazards of confined spaces, and to take appropriate precautions to protect persons working in and around these confined spaces. The purpose of the federal and state standards, and the OGS Confined Space Program is to prevent accidents, injuries and fatalities in confined spaces. The program implements this accident prevention policy through employee training which will equip employees with the knowledge to eliminate or control the hazards associated with entering, working within and exiting confined spaces.

D. Representatives from OGS-Technical Support[1] and Building Systems teams conducted site surveys of known and suspected confined spaces in the Fall of 1996 and made a determination as to which entry procedures are required for each. If OGS elects not to have its employees enter a space, then an evaluation is not required, and the space is to be locked and posted with a warning sign to prevent entry. See Attachment 2 for the

[1] At the time of the 1996 surveys, safety functions were under the Technical Support Unit. Safety functions are currently under the Safety Support Unit.

Confined Space Decision-Making Process and Procedural flowchart, and Attachment 3 for Confined Space Classifications.

II. **POLICY**: All OGS employees, except those trained and equipped as prescribed by this program, are prohibited from entering confined spaces. If a new space is created or discovered that is questionably a confined space, it shall be treated as a permit required confined space until determined otherwise. Permit Required Confined Spaces will be posted with an appropriate warning sign and locked to prevent unauthorized entry. All designated employees, to include contractors, will be notified of the types of confined spaces and their known associated hazards that are located in facilities owned, operated and/or maintained by OGS for which they were hired to perform work. It will be the responsibility of the Safety Support Unit for OGS, and the contractor's responsibility to train and equip their respective employees in accordance with 29 CFR 1910.146/1926.21.

III. **CONFINED SPACE HAZARDS**: There are many hazards that can be found in confined spaces. Therefore, careful planning is required before anyone tries to enter into a confined space. All the hazards that can affect the safety and health of entrants must be determined and addressed through the evaluation process. Hazards in confined spaces can generally be grouped into the following:

A. Atmospheric Hazards: (See definition - Hazardous Atmosphere.) Accidental leaks or spills, oxidation (rusting metals or decomposing organic materials), or by-products produced within a confined space from mechanical operations (welding, painting, cleaning with acids or solvents, scraping, or sandblasting) can give off toxic vapors and fumes. Toxic gases and vapors may displace oxygen such as when using carbon dioxide to fight a fire. They can also be inhaled or absorbed through the skin then incapacitate the body's ability to maintain respiration. Further, repeated or prolonged exposures to some toxic gases and vapors can cause long-term physical damage to the body. While airborne dust and particle concentrations may be easy to spot with the naked eye, oxygen and other gases can be colorless and/or odorless and in concentrations that can only be detected with a reliable instrument. Of all confined space hazards, atmospheric hazards are the most common and are often undetectable.

B. Physical Hazard: After the atmospheric hazards have been identified in a confined space, physical hazards must be identified. Physical hazards may be grinding or welding equipment, agitators, steam or steam fittings, mulching equipment, drive shafts, gears or other moving equipment that can burn, maim, or crush. Uneven or wet surfaces (rain, ground seepage, spills, leaks), pipe fittings, or heights over 6 feet may also pose a slip, trip and fall hazard.

C. Engulfment Hazard: (See definition for Permit Required Confined Space.) Loose materials such as crushed stone, fertilizer, sawdust, etc. are often stored in containers such as silos. The stored material may contain air pockets that can collapse under the weight of an employee. The stored material then can cover the employee's airway or compress the upper chest to the point of suffocation.

D. Corrosive Hazard: Chemicals such as acids, solvents and cleaning solutions can cause serious irritation or burns to the skin, mucous membranes or eyes. Fumes from

these chemicals can also irritate the respiratory system and can cause gastrointestinal distress.

E. Biological Hazard: Molds, mildews and spores frequently found in dark, damp spaces can irritate the respiratory system. Bacteria and viruses, found in applications such as sewage treatment, can also threaten the body with a variety of diseases. Additionally, bird and animal feces can present a serious health hazard for humans.

F. Other Hazards: Poor visibility, inadequate lighting and insecure footing; rodents, snakes, spiders and insects; sudden changes in weather, i.e., rain and wind, are hazards to the entrants in confined spaces.

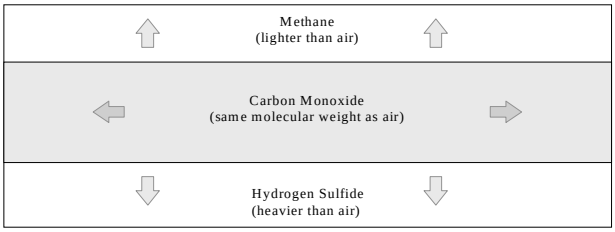
IV. **ATMOSPHERIC TESTING**: All entrants to confined spaces must know how to use a gas monitor. Experts consider the battery-powered, direct-reading instrument to be the most practical device for checking a confined space atmosphere. Depending on the instrument, an employee can monitor for a single gas or simultaneously for two to five gases (see Attachment 5 for operation of the TMX 410 multi-gas monitors used by OGS). If actual and potentially hazardous substances have been identified, then substance-specific sensors should be used because they read the actual concentration levels. If actual or potentially hazardous substances are not identified then broad based sensors may have to be used which have the disadvantage of only warning that the threshold for a class of chemicals has been exceeded.

A. Initial Test: It must be assumed that every confined space has an unknown hazardous atmosphere. *Under no circumstances* should anyone ever enter, or even stick their head into a confined space for a "quick look." The initial atmospheric test will be conducted from OUTSIDE of the confined space (whether that space has been identified for alternate procedures or full permit required procedures). This initial test will determine whether or not an employee may enter the confined space, what type of protective equipment is necessary, and/or the duration of worker exposure.

1. Calibrate, as recommended by the manufacturer, and zero the instrument in known fresh air prior to every use.

2. If possible, do not open the entrance access to the confined space in order to test the atmosphere, i.e., insert a probe through a weep hole or small entry port into the confined space. Opening the access may result in violent reactions between the internal and external atmospheres, or dilute the internal atmosphere giving a false (safe) reading.

3. Testing should include sampling at the top, middle and bottom within the confined space since gases have different densities (some gases are lighter than air, some gases are heavier than air, and other gases have the same weight as air). Sampling should be continuous and at every level (every 4 feet) due to this stratification. Also, some gases may hide in pockets due to reduced ventilation. Use a flexible hose for descents into vertical confined spaces or a rigid probe to test the atmosphere in horizontal situations like a tunnel.



B. Regular Testing: No matter what type of instrument is selected, regular monitoring should be performed during all confined space operations. Even if a gas is not present or is at a particular level upon initial testing, the concentration, combustibility, and/or toxicity may change unexpectedly. Battery-powered monitors should be left on for continuous monitoring to take advantage of built-in alarms. If detector tubes are being used, sampling should be conducted at frequent intervals, i.e., at a minimum of every 30 minutes.

C. Test Equipment (see definition): A number of instruments are available to detect toxic and combustible gases, and levels of oxygen. OGS uses a multi-gas detector (see Attachment 5).

V. **PROCEDURES FOR ENTERING A CONFINED SPACE**: Site determined which entry procedures are required for each space. A space that is not as a confined space or a Permit Required Confined Space requires no special entry procedures. See Attachment 2 for the Confined Space Decision-Making Process and Procedural flowchart. See Attachment 3 for confined space classifications.

A. Permit Required Confined Spaces (PRCS) Procedures:

1. PRCS Entry Permit: Before any OGS employee enters a PRCS, the designated Entry Supervisor must complete and sign a PRCS Entry Permit (see Attachment 3). A hazard assessment of the PRCS must be conducted in order to complete the PRCS Entry Permit. The PRCS Entry Permit provides a written notice of the hazards within the PRCS, controls established for those hazards, personal protective equipment required, and any restrictions upon intended operations in the confined space. The permit should also include cleaning, purging and ventilation requirements, safe work practices, and who and how to summon for rescue and medical services.

a. For situations requiring “hot work,” such as welding, a notation must be added or a hot work permit must be attached to the PRCS Entry Permit detailing the scope and duration of the hot work.

b. To ensure everyone understands their responsibilities, the hazards found in a particular PRCS, and the consequences of exposure to each hazard, the entry supervisor should conduct a pre-entry session for everyone involved. This session should be conducted immediately before entry.

c. Canceling of Permits:

(1) When work inside the PRCS is completed, the Entry Supervisor is to cancel the permit.

(2) Anytime the Entry Supervisor or the Safety Support Unit has any reason to believe the measures being taken under the PRCS Entry Permit do not adequately protect the entrants, the entrants will be directed to leave the PRCS and the PRCS will be reviewed. Examples requiring review: Unauthorized entry, hazard detected not covered or prohibited by the permit, an injury or near miss occurs during entry, a change in configuration or use of the PRCS, and employee complaints about the permit's effectiveness.

(3) Problems are to be noted on or attached to the permit so that changes can be made as required.

(4) The canceled entry permit is to be retained on file by the Safety Support Unit for at least one (1) calendar year from the closure date.

d. The duration of the Entry Permit should only last long enough for the job to be completed. If the permit extends more than one shift, i.e., the job may take several days, a week or more to accomplish, ...

(1) Each new shift must be briefed and accounted for.

(2) Procedures must specify how to close and secure the PRCS at the end of day. Also, next day start up procedures must include initial atmospheric testing and verification of isolation procedures.

2. Isolation or Lockout / Tagout (LOTO) Procedures: Before entering a confined space, utilities and mechanical equipment serving that space should be isolated and disconnected. LOTO procedures must be performed only by an authorized employee.

a. Pipes and steam lines should be blind flanged in the "Off" position and locked out with a padlock.

b. Main breakers to electrical service in the PRCS should be thrown to the "Off" position and locked out at the breaker panel. To be sure the power supply to the equipment has been interrupted, all On-Off switches should be tested.

c. Hydraulic lines serving the PRCS should be blocked and bled to prevent unanticipated movement of the equipment.

d. Drive mechanisms, gears and belts to all mechanical equipment should be physically disconnected before entry into the PRCS.

3. Participants: **UNDER NO CIRCUMSTANCES SHOULD AN EMPLOYEE BE INVOLVED IN A PRCS OPERATION WITHOUT PROPER TRAINING, PERMIT (AUTHORIZATION), AND THE REQUIRED EQUIPMENT.** Every worker involved in PRCS entry operations must fully understand their duties before ever working in a PRCS. OSHA requires the following participants to be trained and certified in hazard recognition, PRCS communications, personal protective equipment, and self rescue.

a. ENTRY SUPERVISOR: (See definition.) Individuals authorizing entry into a PRCS must have a complete understanding of what is inside the PRCS as well as its hazards. The Entry Supervisor must:

(1) Know the hazards of the PRCS and their effects, precautionary measures and personal protective equipment, and the job to be performed.

These must be fully explained to all participants in the written Entry Permit (see Attachment 3).

(2) Designate authorized entrants and attendants on the Entry Permit.

(3) Stipulate on the Entry Permit and verify that all tests have been conducted, that all procedures and equipment are in place, that rescue services are available (on-call or on-site) and the means to summon them are operable. Note: If an off-site rescue service indicates, for any reason, that it would be unable to respond to a rescue summons, entry shall not be authorized unless an adequate alternative rescue service is arranged.

(4) Brief each designated entrant prior to entry on information from the PRCS Entry Permit.

(5) Ensure unauthorized individuals are removed and kept away from the PRCS during entry operations.

(6) After all of the above has been completed, endorse the Entry Permit and make it available to each designated entrant prior to entry, i.e., post it at the PRCS entrance for the duration of entry.

(7) Determine when and to whom responsibility for entry operations is transferred.

(8) Terminate the entry when:

(a) Entry operations covered by the permit are completed.

(b) A condition not allowed by the permit arises in or near the PRCS.

b. ENTRANT: (See definition for Authorized Entrant.) Entrants must determine the following from the Entry Supervisor and/or the entry permit:

(1) What hazards are contained in the PRCS.

(2) The signs and symptoms of exposure to those hazards.

(3) What personal protective equipment is required and how to use it. Each entrant shall use a full body harness attached to a mechanical retrieval system to facilitate non-entry rescue when the PRCS is more than 5 feet deep.

(4) What means of communication is to be used and how to use it. If an attendant is required, entrants must keep the attendant aware of their activities.

(5) What operations are planned and/or allowed.

(6) When to evacuate the PRCS, i.e., self-rescue.

(a) Attendant orders evacuation or an evacuation alarm is activated.

(b) Entrant recognizes a prohibited condition or a warning sign of exposure to a dangerous situation.

c. ATTENDANT: (See definition.) All workers in a PRCS must be observed by at least one attendant located outside of the PRCS. An attendant must remain on duty for the entire time the entrants are inside of the PRCS. Specifically, the attendant:

(1) Is responsible to maintain an accurate account of all workers (by name) that are inside the PRCS. This requirement may be met by inserting a reference on the Entry Permit and attaching a roster.

(2) Is responsible to maintain Material Safety Data Sheets (MSDS) for substances to which the entrants may be exposed. The MSDS will be provided to the medical facility treating any exposed entrant.

(3) Must know and be able to recognize actual and potential hazards related to the PRCS operations. This includes monitoring both inside and outside of the PRCS to determine if there is a danger to the entrants.

(4) Must be able to communicate with every entrant in the PRCS in order to determine their status and order evacuation if necessary.

(5) Must order all entrants to evacuate the PRCS when there is an emergency (see definition) or the attendant must leave. Examples:

(a) Conditions occur which are not allowed by the Entry Permit.

(b) Behavioral changes in the entrants.

(c) An uncontrolled hazard develops in the PRCS or a condition outside of the PRCS could endanger the entrants.

(6) Must keep unauthorized persons from entering the area by instructing them to leave. The entrants and entry supervisor must be made aware of the presence of unauthorized persons.

(7) Must summon and coordinate rescue efforts. Should an unsafe condition or an emergency arise, such as an entrant becoming incapacitated, the attendant:

(a) Must order all entrants to evacuate the PRCS. The first priority is the safety of all individuals.

(b) Should summon assistance.

(c) May effect rescue from outside of the PRCS (non-entry rescue) by operating the retrieval system. Attendants will be trained in 1st Aid and CPR, and should provide emergency care as required.

(d) Must NOT ENTER the PRCS to effect a rescue unless they have been properly trained, equipped and relieved by another authorized attendant.**.** More than 60% of all confined space fatalities occur because an attendant or an unauthorized person rushed into the hazardous environment without proper protective equipment.

d. RESCUE: When practical, non-entry rescue is required by the attendant and/or a rescue team. Rescue services may be provided by either an on-site and/or off-site responders.

(1) On-site rescue teams have the advantage of being immediately available and intimately familiar with the facility. Currently there is no

rescue team trained and certified within OGS. Until such a team exists, rescue may have to be effected by a local rescue service, i.e., the City of Columbia or Richland County fire departments.

(2) The Entry Supervisor will identify and ensure an OGS or an outside rescue team to be on standby and to respond as necessary. If the planned off-site rescue service indicates, for any reason, that it would be unable to respond to a rescue summons, entry shall not be authorized unless an adequate alternative rescue service is arranged.

(3) The rescue team is required to consist of at least two rescuers for all confined space situations. The rescuers will be trained in 1st Aid/CPR and at least one rescuer will be current and certified. Rescuers will wear SCBAs or supplied-air respirators with an air source outside of the confined space. Where practical, the rescuers will wear full body harnesses attached to separate lifelines.

4. Equipment for PRCS Entry: It is essential that each entrant be properly equipped for a PRCS entry. All tools and equipment required to complete tasks in a PRCS must be gathered and checked for good working order before entry.

a. Entrance Barriers: When entrance covers are removed, the opening will be promptly guarded to protect entrants from pedestrian, vehicle and other external hazards. Open man-holes, hatch entrances and other unmarked entrances to the PRCS should be protected against unauthorized entry by a railing, temporary cover or temporary barricade to prevent an accidental fall through the opening and to protect the entrants from the accidental dropping of foreign objects into the PRCS.

b. Respiratory Protection: There are currently no known confined spaces in OGS facilities that require respiratory protection.

(1) If in emergencies where a dangerous atmosphere has developed and a rescue extraction is necessary, the first choice for controlling any respiratory hazard is forced-air ventilation. If this is not practical or successful in bringing the hazardous atmosphere within prescribed limits, respiratory protection equipment is necessary, i.e., self-contained breathing apparatus (SCBA), air-line respirator, air-purifying respirator, etc.

(2) NO OGS EMPLOYEE IS TO ENTER A PRCS REQUIRING RESPIRATORY PROTECTION unless:

(a) There is an emergency rescue situation.

(b) The situation has been thoroughly analyzed and proper respiratory equipment is available, i.e., supplied air respirator (SAR) or SCBA. Selection of respiratory equipment should be made by a qualified individual who understands the site specific requirements, and the capabilities and limitations of the equipment selected.

(c) The rescuer has been trained and is currently certified in that piece of respiratory equipment, and in 1st Aid/CPR.

c. Personal Protective Equipment (PPE): Confined spaces often present situations requiring the use of head, eye, hearing, body, hand and/or foot protection. Most situations require the combined use of several types of PPE to provide maximum protection for the worker. A wide variety of PPE is available and should be worn when entering a PRCS. NO OGS EMPLOYEE SHALL BE DENIED

APPROPRIATE SAFETY EQUIPMENT. It is the supervisor's responsibility to ensure appropriate safety items are available and are properly used, stowed and maintained.

(1) Confined spaces commonly reverberate and amplify even small sounds so the entrants may need to wear ear plugs and/or ear muffs to protect their hearing when operating machinery or equipment in a confined space.

(2) Many of the OGS confined spaces are pits and vertical shafts which present a possible falling object hazard. Entrants to this type of PRCS shall wear hard hats designed to provide top impact protection. As most of our confined spaces are crowded with utility lines, hard hats are recommended to be worn in any PRCS to provide protection from bumping into stationary objects.

(3) If a contaminant in the PRCS is known to be a skin irritant , then the entrant shall wear protective clothing and gloves.

NOTE: In hot environments, especially when workers must wear "non-breathing" protective clothing, heat stress can become an additional hazard in a confined space. Appropriate work breaks, air conditioning, and/or body-cooling systems can be used to prevent heat related health problems.

d. Communications Equipment:

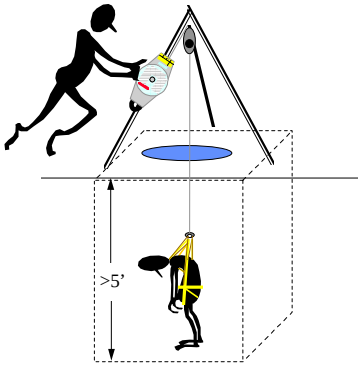
(1) When working inside a PRCS, the entrants must be able to communicate amongst themselves and with the attendant outside.

(2) The attendant must have reliable communications to immediately summon for an emergency rescue. Such equipment may be a cellular telephone or a phone within 25 feet of the PRCS access, or a portable radio where the attendant is in contact with the Facilities Management EMFS Computer Control Room.

NOTE: Lines of communication, especially battery operated devices, should be checked prior to entry operations to ensure they are in good working order, and that the range and reception is adequate.

e. Rescue Retrieval Equipment: Rescue should begin as soon as the rescuer (attendant) becomes aware that rescue is necessary. It is nearly impossible for an average person to pull someone out of a deep manhole without a mechanical advantage. If a PRCS is over 5 feet deep then a mechanical extraction system is required by OSHA. Confined spaces over 50 feet deep require a powered retrieval system with an emergency manual backup mode and a torque-limiter (avoids placing high forces on a victim that snagged on an obstruction).

A mechanical retrieval device is required if the PRCS is over 5' deep



The rescue retrieval system, available from the Maintenance Team, consists of:

(1) Two personnel hoists (winches with a brake and 50' of steel cable each).

(2) A materials winch (used to raise and lower tools and equipment so the entrant is never tempted to disconnect from their lifeline).

(3) A tripod with locking legs to reduce the opportunity for collapse from lateral movement. This 7' tripod typically can be used for a 3' or smaller openings. Davits (floor/wall/truck mounted) should be used instead of a tripod when the confined space opening for vertical entry is greater than 3 feet.

(4) A full body harness with a back D-ring worn by each entrant.

NOTE: The rescue retrieval system has a maximum capacity of 300 pounds. Even though there are three winches, this means that normally only one winch will be in operation at any time.

f. Lighting: Entrants must be able to see well enough to work safely and to exit the space in an emergency.

g. Other Equipment: Employees should be equipped with whatever is necessary for safe entry and egress from the PRCS, i.e., a ladder.

5. Emergency Evacuation: THE DEVELOPMENT OF A HAZARDOUS ATMOSPHERE OR ANY HAZARDOUS CONDITION IN OR IN THE VICINITY OF THE CONFINED SPACE, OR A MULTI-GAS MONITOR WARNING OR FAILURE IS AN EMERGENCY SITUATION REQUIRING ALL ENTRANTS TO ***IMMEDIATELY EVACUATE*** THE CONFINED SPACE. After the emergency evacuation, an Entry Supervisor will:

a. Evaluate the space to determine how the hazardous atmosphere or condition developed.

b. Implement measures to protect entrants from the hazardous atmosphere or condition before any subsequent entry takes place.

B. Alternate Permit Required Confined Space Procedures (PRCS- Alt): When all hazards within a PRCS, except for a hazardous atmosphere, can be controlled from outside of the confined space, OSHA allows the use of an alternate entry procedure where the atmospheric hazard is controlled/made safe by ventilation.

CAUTION: Because conditions in any space can change which could make permit procedures required, all spaces must be properly evaluated prior to and continuously during each entry.

1. Prior to Entry: The employer (Entry Supervisor) must:

a. Demonstrate (see definition) that the ONLY hazard posed by the PRCS is an actual or potentially hazardous atmosphere.

b. Demonstrate that forced air ventilation (see definition) alone will maintain the PRCS safe for entry.

(1) The Entry Supervisor or a designated tester must make the initial atmospheric testing within the PRCS. The monitoring data will be documented (see Attachment 3 PRCS Entry Permit). NOTE: If entry into the PRCS is required to obtain the data or to eliminate hazards then full PRCS procedures will be used. If testing and inspection during this entry demonstrate that the hazards have been eliminated, the

PRCS may be reclassified for PRCS-Alt procedures for as long as the hazards remain eliminated.

(2) Entry records for the previous year must be consulted to determine any hazardous conditions or problems that occurred within that PRCS.

(3) Mechanical ventilation systems, where applicable, shall be set at 100 percent outside air.

(4) Where possible, open additional access doors, ports, or panels to increase air circulation.

(5) If the tests indicate the atmosphere inside the PRCS is unsafe, before any employee is permitted to enter the PRCS, it shall be ventilated, i.e., portable blowers, until the hazardous atmosphere is removed. After a suitable period of ventilating, repeat the atmospheric test. Entry may not begin until testing has demonstrated that the hazardous atmosphere has been controlled. Ventilation shall be continued so as to prevent the hazardous atmosphere from recurring as long as an employee is in the PRCS.

(a) The air supply for the forced air ventilation shall be from a clean source and may not increase the hazards in the space.
The forced air ventilation may be directed to ventilate the immediate areas where an employee will be present.

(6) If the tests indicate the atmosphere inside the PRCS is safe, the entrant may go in and stay inside the PRCS as long as no other hazardous condition develops and the atmosphere remains safe.

CAUTION: Control of atmospheric hazards through forced air ventilation does not mean the hazard has been eliminated. This means that ALT-PRCS PROCEDURES CAN NOT AUTOMATICALLY BE USED FOR EACH PLANNED ENTRY. Every time before any employee is to enter a PRCS, the internal atmosphere must be tested and the confined space examined to the fullest extent possible from outside of the confined space to determine internal hazards. ***The ONLY time Alt-PRCS procedures can be used is when all internal hazards except for the atmosphere can be controlled from outside of the PRCS, and the atmosphere can be controlled by forced air/mechanical ventilation alone to bring the internal atmosphere within allowed limits.***

c. Verify through a written certification that the space is safe for entry and the pre-entry measures have been taken (see first portion of Attachment 3 PRCS Entry Permit). This certification shall be made before entry and shall be made available to each employee entering the PRCS.

2. Entry Procedures:

a. Atmospheric Testing: The entrants must carry atmospheric test equipment inside the PRCS. Periodic testing is required during entry to assure that ventilation is preventing the accumulation of a hazardous atmosphere; continuous monitoring is recommended. Even though continuous mechanical ventilation may not be required to create and maintain a safe atmosphere inside the PRCS, continuous monitoring of the internal atmosphere is mandatory to ensure continued safe concentrations. Documentation of atmospheric sampling should be conducted at frequent intervals, i.e., at a minimum of every 30 minutes.

b. Emergency Evacuation: THE DEVELOPMENT OF A HAZARDOUS ATMOSPHERE OR ANY HAZARDOUS CONDITION IN OR IN THE VICINITY OF THE CONFINED SPACE, OR A MULTI-GAS MONITOR WARNING OR FAILURE IS AN EMERGENCY SITUATION REQUIRING ALL ENTRANTS TO ***IMMEDIATELY EVACUATE*** THE CONFINED SPACE.

(1) An Entry Supervisor will evaluate the space to determine how the hazardous atmosphere or condition developed.

(2) Measures shall be implemented to protect entrants from the hazardous atmosphere or condition before any subsequent entry takes place.

VI. **TRAINING**:

A. PRCS Training:

1. Before employees are first assigned duties associated with permit required confined space work, whenever there is a change in PRCS operations that presents a hazard for which the employee is not prepared, the employee must be trained.

2. Whenever the Entry Supervisor or someone from the Safety Support Unit has reason to believe there are severe deviations or a number of deviations from required procedures, the employee must receive remedial training.

3. Training must be certified by the Safety Support Unit by documenting the date of training, the employee's name, and have the employee's signature, test score, and the trainer's initials on the attendance sheet.

B. Respirator Training (reference 29 CFR 1910.134 Respiratory Protection): Employees designated to wear respirators must first receive the required medical clearance, training and be properly fitted with an appropriate respirator.

C. Rescue Training:

1. Safety Support will familiarize the rescue service with OGS confined spaces so they may develop appropriate rescue plans and practice rescue operations from a simulated or actual confined space. It is recommended for the rescue team to plan and practice a simulated rescue operation annually from at least one actual OGS PRCS.

2. Each member of the rescue service will be trained in 1st Aid and CPR with at least one member holding current certification.

ATTACHMENTS:

1. Definitions
2. Confined Space Process
3. OGS Confined Space Classifications
4. Permit Required Confined Space Entry Permit
5. TMX 410 Multi-Gas Monitor Operations
6. Atmospheric Purge Chart
7. Contractor Operations

Attachment 1

D E F I N I T I O N S

Acceptable Entry Conditions: The conditions that must exist in a permit required confined space to allow entry and ensure employees can safely enter into and work inside the space.

Attendant: A designated person stationed outside the permit required confined space that maintains constant communication with all confined space entrants, warns them of hazardous conditions to include emergency evacuation, and conducts outside/non-entry extraction actions, as required. This person shall be trained in all permit required confined space procedures, and 1st Aid/CPR.

Authorized Entrant: An employee authorized by the employer to enter a permit required confined space.

Confined Space: A space which is large enough for a worker to bodily enter and perform assigned work. The space must also have limited or restricted means for entry or exit, i.e., the person must bend over or crawl or climb into/out of the space. Additionally, the space is not designed for continuous employee occupancy. All three factors must exist simultaneously to be a confined space. The determination of whether a space has limited or restricted entry means the configuration or other characteristics of the space would interfere with an entrant's ability to escape or be rescued in an emergency situation. Examples of confined spaces: Tanks, vessels, manholes, underground vaults, tunnels, boilers, and pits. Spaces large enough to walk into, with clear visibility from end to end, and good ventilation are generally not classified as a confined space.

1. Access by simply reaching in, i.e., into a cabinet or control panel, is not considered bodily entry relative to confined spaces unless the space can contain the whole body.
2. Stairs or ladders will be considered a limited or restricted means of egress when they interfere with the entrant's ability to exit or be rescued from the space in a hazardous situation.
3. The presence of a door does not in itself mean that the space is not a confined space. A door leading to a space that has pipes, conduits, ducts, or equipment or materials that an employee would be required to crawl or squeeze over, under or around in order to escape has a limited or restricted means of exit.
4. Similarly, if an employee has to crawl to gain access, i.e., the door or portal is too small to allow an employee to walk through upright and unimpeded, it will be considered a limited or restricted means of exit.
5. The distance (time) an employee must travel in a space, such as a tunnel, to reach a point of safety can also mean the space has a limited means of exit.

Demonstrate: To prove by actual performance or knowledge, or to provide conclusive data that supports the methodology. Example: To pass a written test, or show use of proper procedures. Example: The use of Alternate Permit Required Confined Space procedures requires the *demonstration*, i.e., with supporting air sample data, that the only

hazard posed by the confined space is an actual or potential atmosphere that forced air alone will maintain safe for entry.

Emergency: Any occurrence or event internal or external to the confined space that could endanger entrants to include failure of hazard control or monitoring equipment.

Entry: The point where any part of the entrant's body breaks the plane of an opening into a permit required confined space.

Entry Permit: A written document provided and signed by the Entry Supervisor that controls entry for authorized entrants into a permit required confined space (see Attachment 3).

Entry Supervisor: The person designated by the employer responsible for determining if acceptable entry conditions exist at a permit required confined space. This person plans, authorizes, monitors and terminates entry operations as required.

Explosive Limits: When certain proportions of combustible vapors are mixed with air and a source of ignition is present, an explosion can occur. This explosive range includes all concentrations where a flash will occur or a flame will travel if the mixture is ignited.

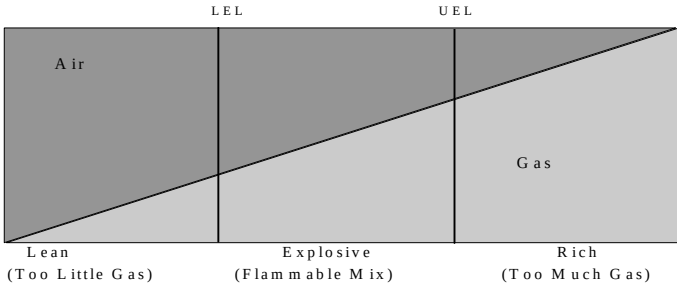
1. Lower Explosive Limit (LEL): The lowest percentage concentration of the explosive range at which an air-fuel mixture will ignite. Below this limit the mixture is too lean to burn.
2. Upper Explosive Limit (UEL): The highest percentage concentration of the explosive range where the air-fuel mixture can still be ignited. Above this concentration the mixture is too rich to burn.

Hazardous Atmosphere: An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (escape unaided from a permit required confined space), injury, or acute illness from one of the following:

1. Flammable gas, vapor or mist in excess of 10 percent of it lower flammable limit (LFL). A safe for entry atmospheric reading would be 50 percent of the LFL.

A. Combustible Gases: Leaking gases can produce an extremely combustible atmosphere and can be set off by even the slightest ignition. In order for combustion to occur there must be fuel (gas vapor), oxygen (to support combustion) and a source of heat or ignition. The gas-to-air mixture or ratio determines whether the gas will burn or not. An atmosphere becomes flammable when the ratio of oxygen to combustible material in the air is neither too rich nor too lean for combustion to occur. NOTE: When dangerous atmospheres are attributable to flammable and/or explosive substances, lighting and electrical equipment shall be Class 1, Division 1 rated per the National Electrical Code and no ignition sources shall be introduced into

the PRCS.



1) Lean: There is not enough oxygen in the gas-air mixture to burn.

2) Explosive: Just the right amount of air and gas exist to form a flammable/explosive mixture.

3) Rich: There is too much oxygen in the gas-air mixture to burn.

4) Combustible: A material with a flash point at or above 100^0F. (Flash point is the minimum temperature at which an ignition source can cause vapors from a combustible material to ignite.)

5) Flammable: A material with a flash point below 100^0F.

2. Airborne combustible dust at a concentration that meets or exceeds its LFL (obscures vision at 5 feet or less).

3. Oxygen concentration below 19.5 percent (deficiency) or above 23.5 percent (enrichment). A safe for entry atmospheric reading would be an oxygen level between 19.5 and 23.5 percent.

A. Oxygen Deficiency: Normal ambient air has a 20.8% concentration of oxygen. When this concentration gets below 19.5%, the human body is deprived of its requirement, i.e., asphyxiation occurs. Oxygen consumption results from combustion of flammable substances, chemical reactions, or from respiration. Displacement occurs when another gas moves the oxygen out of the way. Individuals react differently and at varying rates depending on their health, amount of their activity, amount of exposure, and the number of people involved. Because of a lack of ventilation in confined spaces, oxygen deficiency is perhaps the most common atmospheric hazard. Typically individuals react as follows:

% OXYGEN	PHYSIOLOGICAL EFFECT
19.5-16	No visible effect
16-12	Faster breathing and heartbeat; impaired thinking, attention and coordination
14-10	Faulty judgment, poor muscle coordination, rapid fatigue; intermittent breathing
10-6	Nausea, vomiting; may not be able to move or move vigorously; unconsciousness and possible death
<6	Death in minutes

B. Oxygen Enrichment: When the oxygen concentration gets above 23.5% there is a significant increase in the likelihood and severity of a flash fire or explosion.

4. Concentration of any substance in an employee exposure in excess of its dose or 8-hour time weighted average permissible exposure limit (PEL); reference Material Safety Data Sheet, or Subpart G or Z of 29 CFR 1910. A safe for entry atmospheric reading would be 50 percent of the PEL.

5. Any atmospheric condition that is immediately dangerous to life or health, i.e., Toxic Gases. A toxic gas is a substance in gaseous form that is poisonous usually resulting from a manufacturing process, stored products or certain operations such as cleaning with chemicals

or welding. Effects on individuals vary depending on their age, sex, weight, overall state of health, amount of activity, and amount of exposure/degree of toxicity.

A. Carbon Monoxide (CO): A colorless, odorless, tasteless and non-irritating poisonous gas generated by the incomplete combustion of common fuels when there is not enough oxygen mixed with the fuel ("rich" mixture). CO is often released due to improperly vented or malfunctioning combustion appliances such as gas or oil burning furnaces, stoves, hot water heaters, and by internal combustion engines. CO poisoning may occur suddenly. The Environmental Protection Agency states a person should not breath 9 ppm (parts per million) of CO or over for any 8 hour period, or 200 ppm or over at any one time.

CO	
PPM	PHYSIOLOGICAL EFFECT
200 ppm - 3 Hrs or 600 ppm - 1 Hr	Headache and discomfort (Life threatening after time indicated)
1000 ppm - 1 Hr or 500 ppm - 30 Mins	Heart pounds, dull headache, dizziness, flashes before the eyes, ringing in the ears, nausea and convulsions; death within 2 Hrs
1500 ppm - 1 Hr	Above signals within 20 minutes; death within 1 Hr
4000 ppm	Rapid collapse, unconsciousness and death within a few minutes

B. Hydrogen Sulfide (H_2S): A colorless gas that smells like rotten eggs. However, the gas desensitizes the nose so the smell disappears quickly after breathing only a small quantity of the gas. H_2S is often found in sewers, and around sewage treatment and petrochemical operations. H_2S is also flammable and can be explosive in high quantities.

H_2S	
PPM	PHYSIOLOGICAL EFFECT
18-25 ppm	Eye irritation
75-150 ppm for several hours	Slight eye, respiratory irritation
170-300 ppm - 1 Hr	Nausea, stomach distress, eye irritation, belching, coughing, headache and blistering of lips
400-600 ppm for 1/2-1 Hr	Unconsciousness and death
1000 ppm	Death in minutes

C. Aromatic Hydrocarbons (i.e., Benzene, Toluene, Xylene):

1) Benzene: A colorless, flammable, volatile liquid with a rather pleasant aromatic odor. Chronic poisoning may occur after breathing relatively small amounts over a short period of time. First sign is exhilaration followed by sleepiness, dizziness, vomiting, trembling, hallucinations, delirium and unconsciousness. Benzene is a suspected carcinogen.

2) Toluene: A colorless, flammable liquid, a strong aromatic odor warns of high concentrations. It produces extreme fatigue, mental confusion, exhilaration, nausea, headache and dizziness.

3) Xylene: A solvent mixture that resembles benzene.

D. Ammonia (NH_3): A strong irritant that can produce sudden death from bronchial spasms. Small amounts may be inhaled without severe irritation and are quickly metabolized in the respiratory tract. Can be explosive when the contents of a tank or refrigeration system are released into an open flame.

NH_3	
PPM	PHYSIOLOGICAL EFFECT
30-500 ppm for ½-1 Hr	Eye and throat irritation
400 ppm	Throat irritation
2500-6000 ppm for ½ Hr	Dangerous to life
5000-10,000 ppm	Fatal

SUBSTANCE	THRESHOLD LIMIT VALUE (PPM)	SHORT TERM EXPOSURE LIMIT (PPM)	OSHA PERMISSIBLE EXPOSURE LIMIT (PPM)
Carbon Monoxide	25	-	50
Hydrogen Sulfide	10	15	10
Sulfur Dioxide	2	5	5
Ammonia	25	35	50
Benzene	10	5	1
Toluene	50	150	200
Xylene	100	150	100

Hot Work Permit: The employer's written authorization to perform operations capable of providing a source of ignition, i.e., welding, cutting, burning, heating. Note: Maintenance work requiring welding or open flame, where toxic metal fumes such as cadmium, chromium or lead may be involved, shall only be done with sufficient local exhaust and/or with appropriate respiratory protection. Solvents and vapors must be cleared before welding or the use of open flame is permitted.

Immediately Dangerous to Life or Health (IDLH): Any condition that poses an acute (immediate) threat to life or irreversible adverse health effects or that would interfere with an individual's ability to escape unaided (self-rescue) from a space, the permit required confined space "serious safety and health hazard" classification is "triggered." Example: The mere presence of water in a confined space such as a manhole is not by itself IDLH. However, when there is a sufficient quantity to endanger the entrant's life or hinder escape, or if the water conceals another hazard, like a trip and fall hazard, the confined space should be classified as a permit required confined space.

Isolation: The process of removing a permit required confined space from service by completely protecting against the release of hazardous energies and materials into the space by means of Lockout/Tagout, blanking/blinding, misaligning or removing sections of lines, pipes or ducts, etc.

Non-Permit Required Confined Space: A confined space that does not contain any hazard capable of causing death or serious physical harm.

Permit Required Confined Space: A confined space that has a potential to contain a hazardous atmosphere, contains a material that has the potential to engulf an entrant, has an internal configuration such that could trap or asphyxiate an entrant (due to inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section), or contains any other recognized serious safety or health hazard.

Retrieval System: The equipment used for non-entry rescue of persons from a permit required confined space. This equipment includes a full body harness (a series of adjustable leg, body, and shoulder straps) with a back D-ring connected to a lifeline and an anchor used as a fall protection system which distributes the impact of a fall over a large area of the body. Also included is a mechanical raising and lowering device with a

brake that can be used for normal positioning but is required if the permit required confined space is over 5 feet deep. The hoisting and lowering unit is normally attached to a tripod. However, tripods are not appropriate for some confined spaces which may require davits and/or brackets specially designed for the work space.

Test Equipment (Gas Monitor): The hazards that an entrant may encounter must be identified and evaluated prior to entry, and continuously monitored during entry and rescue operations. Various atmospheric sampling instruments are available to test and monitor changing levels of oxygen, and flammable/combustible and toxic gases. The monitor is a proactive tool. It alerts workers about existing atmospheric hazards in the confined space that are undetectable by human senses. Otherwise, these hazardous atmospheric conditions could overwhelm workers in the confined space. In confined space entry, no other equipment is more important than the gas monitor.

1. Single Gas Monitor: Used to test the internal atmosphere for oxygen deficiency; sensors may be changed or other monitors will have to be used for other sampling purposes.
2. Multiple Gas Monitor: Usually configured with sensors to simultaneously test the internal atmosphere for oxygen content, flammable gases and vapors, and potential toxic air contaminants. OGS uses this type of instrument.
3. Alarm Only Devices: Provide an alarm when concentrations for the gas to be detected reach a predetermined level. These devices do not provide "real time" readings and, therefore, are not acceptable for initial (pre-entry) or periodic atmospheric testing.

Ventilation: When the atmosphere in a space has been contaminated, continuous clean air is introduced/forced into a space with the purpose of decreasing the concentration of the air contaminant to the degree that there no longer is a hazard to the worker. Effectiveness is determined by the number of times the air in the space is changed; often measured in cubic feet per minute.

1. Forced Air Ventilation: A mechanical system forces air into a space and/or exhausts air from that space. The supplied air ventilation for the space must not cause ventilation imbalances that would create hazards in the work area from which the supply air is taken. Also, the exhaust discharge of contaminants from the space to adjacent areas must not endanger the employees of other work areas.
2. Natural Ventilation: Air enters a space through openings such as doors, windows, portals, etc. resulting in a circulation.

Attachment 2

CONFINED SPACE PROCESS

The following flowchart describes the confined space process and delineates specific actions based on it's classification as:

1) Not a Confined Space
2) A Permit Required Confined Space
3) A Permit Required Confined Space where Alternate Procedures are Allowed

Attachment 3

OGS CONFINED SPACE CLASSIFICATIONS

The following list classifies the known spaces that exist in facilities owned, operated and/or maintained by the Office of General Services. The classifications are:

1) Use Permit Required Confined Space Procedures
2) Use Alternate-PRCS Procedures
3) Confined Space (Do Not Use PRCS or Alt-PRCS Procedures)
4) Not a Confined Space

Attachment 4

PERMIT REQUIRED CONFINED SPACE ENTRY PERMIT

The Entry Supervisor is required to fill in specific information in the attached form, brief all participants involved in the Permit Required Confined Space entry, provide a copy of this form for the site and send the closed entry permit to Safety Support to keep on file for at least one year’s reference.

OFFICE OF GENERAL SERVICES

CONFINED SPACE ENTRY PERMIT

THIS PERMIT IS TO BE KEPT AT THE JOB SITE
UNTIL THE JOB IS COMPLETED
COPY to Entry Supervisor
COPY at Job Site (To be Returned to Safety Support Following Job Completion)

DURATION: This permit is valid only for the following time frame:

ISSUE DATE: _____ TIME: _____
EXPIRES ON - DATE: _____ TIME: _____

SITE LOCATION: _____
(Building Name/Number, Street Address, Room Number, etc.)

PURPOSE OF ENTRY: _____
(Equipment to be Worked On and Type of Work)

_____

1. **INITIAL ATMOSPHERIC CHECK**: Instrument Used - TMX410 ___
   CO ____ ppm H_2S ____ ppm Other _____
   0_2 ____% LFL ____ %
   Acceptable Levels for Entry:
   $19.5\% < 0_2 < 23.5\%$ CO < 50 ppm
   LFL < 10 % H_2S < 10 ppm

   Tester's Signature _____ Date/Time _____

2. **HAZARD ISOLATION**, i.e., Lines Blinded, Disconnected or Blocked. The following measures are to be used to eliminate/control hazards in the confined space:

HAZARD	CONTROL	COMPLETE

3. **VENTILATION**:

Mechanical	Yes ___	Purge Time _____	N/A ___
Natural	Yes ___		N/A ___

4. **ATMOSPHERIC CHECK AFTER ISOLATION & VENTILATION**:

CO ____ ppm H_2S ____ ppm Instrument Used - TMX410 ___

0_2 ____% LFL ____ % Other _____

Tester's Signature _____ Date/Time _____

5. **COMMUNICATION PROCEDURES**:

____ VOICE ____ TWO-WAY RADIO

OTHER: _____

6. **RESCUE PROCEDURES**:

____ Two-Way Radio to EMFS Computer Control Room Checked

____ Telephone Available to Call Rescue Services and Checked

Located at _____ PHONE: _____

(Within 25 feet of PRCS)

____ Rescue Service Coordinated and On Stand-By

UNIT: _____ PHONE: _____

Address: _____

____ Use Non-Entry Rescue Retrieval

OTHER:

7. **TRAINING**: TRAINED ON

ATTENDANT: _____ PRCS _____ SFA _____

(Name) (Date; within Last Year) (Date; within Last Year)

ATTENDANT: _____ PRCS _____ SFA _____

AUTHORIZED

ENTRANTS: _____ PRCS _____ SFA _____

(Name) (Date; within Last Year) (Date; within Last Year)

_____ PRCS _____ SFA _____

_____ PRCS _____ SFA _____

_____ PRCS _____ SFA _____

_____ PRCS _____ SFA _____

RESCUE: _____ PRCS _____ SFA _____

_____ PRCS _____ SFA _____

8. **OTHER HAZARDS**: The following measures are to be used to eliminate/control hazards during the confined space entry.

HAZARD CONTROL COMPLETE

9. **EQUIPMENT**: Enter "N/A" for items that do not apply. COMPLETE

Direct Reading Gas Monitor - Tested _____

Fall Arrest/Restraint, Each Entrant - Inspected _____

Full Body Harness w/ Back D-Ring
Lifeline & Connectors

Rescue Retrieval System - Inspected _____

Tripod
Personnel and/or Equipment Winch (Raise, Lower, Brake, Line)

Communications - Fresh Batteries & Tested _____

For Summoning Rescue
For Talking Between Entrants & Attendant

PPE - Inspected

Hard Hat _____

Hearing Protection (Plugs or Muffs) _____

Eye Protection _____

Safety Glasses Face Shield
Chemical Goggles Welders

Respirator _____

1/2 Face Full Face
SCBA Other, Type: _____
Type Cartridge _____
Last Trained on _____

Fit Tested _____

Outer Garment _____

Apron Coveralls Other: _____

Gloves, Type: _____ _____

Footwear, Type: _____

Portable Lighting & Electrical Equipment _____

Required to be NEC Class 1, Div 1 Yes __ No __

OTHER:

I VERIFY THAT ALL OF THE ABOVE PRE-ENTRY PREPARATIONS HAVE BEEN COMPLETED, THE ENTRANT(S) AND ATTENDANT(S) HAVE BEEN BRIEFED AND PROPERLY EQUIPPED, AND THAT THE SPECIFIED CONFINED SPACE IS SAFE TO ENTER.

ENTRY SUPERVISOR: _____ PHONE: _____
(Name)

ALTERNATE
ENTRY SUPERVISOR: _____ PHONE: _____
(Name)

Entry Supervisor's **SIGNATURE** _____ DATE: _____

CONFINED SPACE ENTRY
PERIODIC ATMOSPHERIC TESTING

Continuous monitoring results should be recorded by the entrant every 2 hours. Peak Readings will be annotated when the work is completed.

Location _____
Instrument Used - TMX410 ___ Other _____

READINGS

DATE: _____

TIME	CO ppm	H_2S ppm	0_2 %	LFL %
PEAK READING				

ENTRANT(S):

Attachment 5

TMX 410 MULTI-GAS MONITOR OPERATIONS

The monitor used by OGS for hazardous atmospheric detection and alarm during a confined space entry is the TMX 410 Multi-Gas Monitor by Industrial Scientific Corporation. It is a diffusion instrument which means it measures the air directly in contact with it. The monitor is powered by a 7.5 volt nickel cadmium battery. The unit can be carried by a hand strap or in a belt holster. The instrument is configured with gas specific sensors to simultaneously detect concentrations of oxygen, carbon monoxide, hydrogen sulfide and combustible gases. There is a visual display which simultaneously shows the real-time levels of the four sensor readings. When the pre-set warning levels are exceeded, an audible alarm and a red light will come on to alert the user of a dangerous situation requiring immediate evacuation of the permit required confined space. Additionally, there is a battery-powered pump attachment to allow the monitor to be used as a sample draw instrument, i.e., the motorized pump draws in an atmospheric sample through a neoprene tube to the monitor. OGS has two monitors. One monitor, pump and extra battery are kept in the Facilities Management Training Resource Room for check out. Another monitor and pump are kept in the Horticulture Office at the Governor's Mansion.

SENSOR SETTINGS: Do not change the instrument's sensor alarm settings. Only Safety Support should perform maintenance on the instrument. The TMX 410s are set to the following:

SUBSTANCE	LOWER LIMIT	UPPER LIMIT
Oxygen	19.5%	23.5%
Combustible Gases	10% LFL	-
CO	50 ppm	
Hydrogen Sulfide	10 ppm	-

WARNING: Erroneous instrument readings may result from:

- Out of limits oxygen atmospheres for a combustible gas
    - Deficient oxygen will cause a low combustible gas reading
    - Rich atmosphere will cause a high combustible gas reading
- Any rapid or erratic change in one or more readings or off-scale readings may indicate a hazardous atmosphere
- Silicone compound; verify the instrument calibration prior to continued use if it has been exposed to such chemicals
- Dirty Sensor Dust Screen; must be kept clean
- Low battery level

BATTERY CHARGING: Turn off the instrument and place it on the battery charger. Horticulture has a single trickle charge unit which takes approximately 10 hours to charge. OGS also has a double charge unit with a selectable trickle charge rate or a high charge rate which takes about 4.5 hours to charge. When fully charged, the battery should power the instrument for about 10 hours (light off; shorter with the light on). A short beep should sound every 30 seconds when the battery is getting low (30-90 minutes charge remaining). When there is not enough charge remaining in the battery to run the instrument, a Battery Fail message should appear on the display and a short beep should sound each second. When the Battery Fail message appears, turn off the instrument, and replace the battery or charge it.

ON/OFF: There is a cover on the front of the instrument which is over the On/Off and other calibration switches. Loosen the finger nut and rotate the cover to expose the switches. The On/Off switch is to the upper right of the finger nut. Slide the On/Off toggle switch to the left to turn the instrument On (to the right for Off). The instrument will do a self-test for approximately 2 minutes at the end of which there may be a short beep. During the self-test, the display number segments all appear, followed by a battery voltage readout, chemical sensor display locations, a self-test message, and then sensor readings. The oxygen level initially will be high which means the warning light will flash and a warbling alarm will sound. However, the oxygen reading should drop and the light and alarm should turn off when it falls below 23.5%. Reposition the calibration cover and tighten the finger nut.

CALIBRATION: Safety Support will calibrate the monitors about every 3 months or every 20 uses, whichever occurs first. Calibration requires specific test gases and an adapter fitting.

ZEROING: Sometimes the sensor readings will start "floating" away from their pre-set levels. By using the Zeroing mode, the sensor readings can be reset. The instrument should be Zeroed prior to each use. To Zero, press and hold the black Mode button until the Zero message appears. Then take a pen and depress the "E" button (to the immediate left of the finger nut). When the Zero cycle is complete, a short beep will sound and the instrument is ready to use. ***WARNING***: Only ZERO the instrument in clean air (normal oxygen concentration).

PEAK READINGS: You should frequently monitor the instrument and document readings about every 30 minutes. Peak readings can be obtained by pressing and holding the Mode switch until the Zero message appears. Then press the Mode switch once more and Peak Readings should appear on the display. Prior to turning off the instrument, these values should be cleared. Press the Mode switch again and the "Press (E) to Clear" message should appear. After the Peak Readings have been cleared, you can return to the normal mode by pressing the Mode switch until it appears, or you can turn off the instrument.

ALARMS: When a monitored gas reaches its pre-set level an alarm will sound.

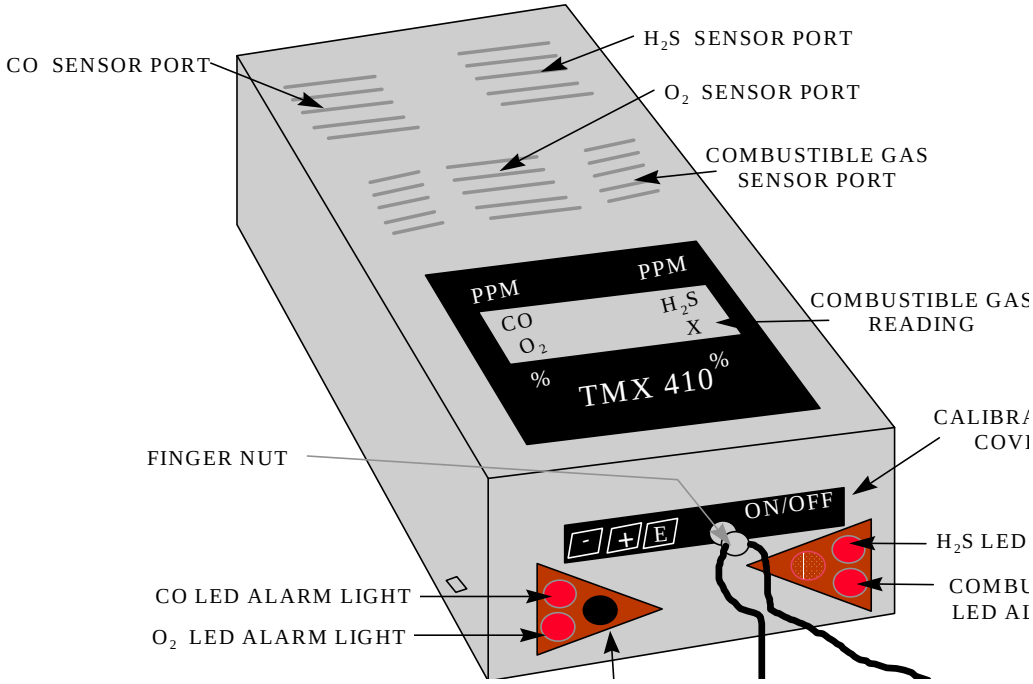
- If the reading exceeds the high level, the instrument emits a continuous high-pitched warbling tone and a bright red light flashes. The red light corresponds to the sensor reading position on the display.
- If the reading goes below the low level, the instrument emits a short beep about every second and a bright red light flashes.

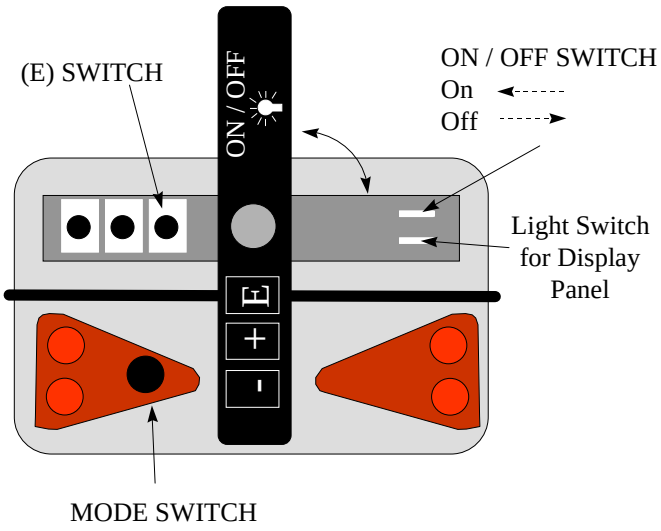
NOTE: The low alarm signal for oxygen deficiency is the same as the high level alarm.

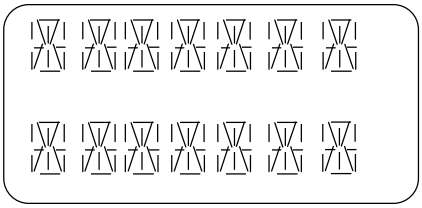
LOW BATTERY WARNING: Depending on the battery condition, a low battery warning, a short beep, will sound about every 15 seconds. The low battery warning should provide 30 to 90 minutes advance warning of battery failure.

BATTERY FAILURE: When the battery has lost sufficient charge to power the instrument, the instrument will stop monitoring, a "Battery Fail" message is displayed, and a short beep is emitted about once per second. When this message appears, turn off the instrument and recharge or replace the battery.

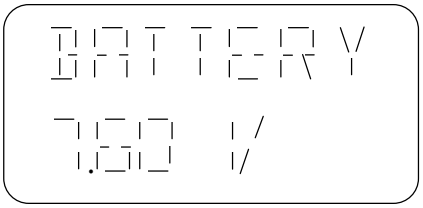
FAULT: If a new sensor has been improperly installed, the instrument, when first turned on, will emit a short beep once per second and the corresponding display reading will flash. Should this occur, turn the instrument in to Technical Support for calibration; the TMX410 must be calibrated whenever a sensor is installed or replaced.


CO SENSOR PORT
H2S SENSOR PORT
O2 SENSOR PORT
COMBUSTIBLE GAS SENSOR PORT
PPM
PPM
CO
O2
H2S
X
%
TMX 410
%
COMBUSTIBLE GAS READING
CALIBRA
COVI
FINGER NUT
ON/OFF
- + E
H2S LED
COMBU
LED AI
CO LED ALARM LIGHT
O2 LED ALARM LIGHT

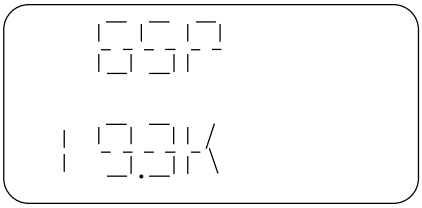

(E) SWITCH
ON / OFF
ON / OFF SWITCH
On
Off
Light Switch for Display Panel
E
+
-
MODE SWITCH



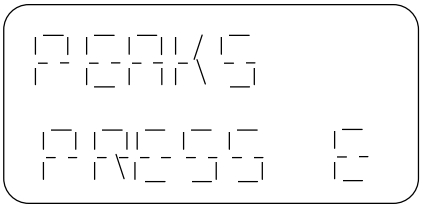
DISPLAY TEST



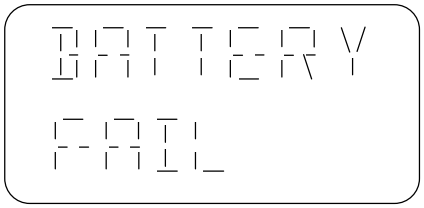
BATTERY (LEVEL)



PK (PEAK READINGS)



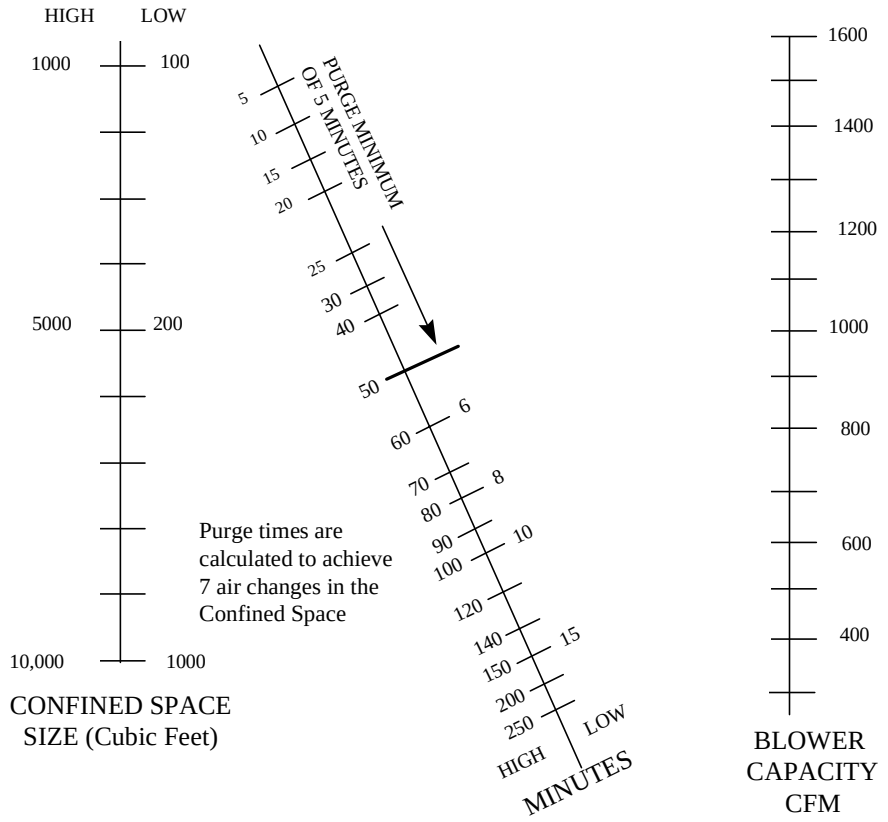
PEAKS (CLEAR VALUES)



BATTERY FAILURE

Attachment 6

ATMOSPHERIC PURGE CHART



HOW TO USE PURGE CHART

1. Place one end of a straight edge on the Confined Space Cubic Feet scale (on left). Be sure to select the proper size scale, High or Low depending on the size of the confined space.
2. Place the other end of the straight edge on the Blower Capacity scale (on right).
3. Read the required Purge Time from the diagonal scale. Be sure to read the proper scale, High or Low volume blower capacity.

NOTE: If 2 or more blowers are used, add their capacities.
NOTE: If toxic/combustible gases or low oxygen is encountered, increase purge times by 50%.

PURGE EXAMPLES:

1. Using a 750 CFM blower for a 6,000 CuFt confined space, it will take 60 minutes to purge. A 1570 CFM blower will take 27 minutes for the same space.
2. Using a 750 CFM blower for a 600 CuFt confined space, it will take 6 minutes to purge. A 1570 CFM blower will take 5 minutes for the same space.

Attachment 7

CONTRACTOR OPERATIONS

The most effective way to ensure safe contractor operations is to use a qualification and selection process, then to coordinate any joint operations, and monitor contractor operations.

A. CONTRACTOR QUALIFICATION PROCESS: Potential contractors must be told that the work space contains confined space hazards and that OGS has a Confined Space Program with which they must comply. The qualification process should establish the competence of the contractor for confined space work prior to allowing the contractor to bid on any work. Several key elements should be obtained from the contractor and reviewed by the Safety Support Unit before any work begins:

1. Overall safety program.
2. Confined Space procedures to include:
    a. Confined Space Permit program.
    b. Confined Space Rescue procedures.
    c. Hot work procedures, if job required.
    d. Confined Space safety equipment list to include inspection, calibration and maintenance record procedures (actual records should be made available upon request after selection).
3. A list of trained entrants, attendants, entry supervisors, and rescue, as applicable. Confined space training records should also be available for these individuals along with any associated (respirator, welding, etc.) training/certification records required by the job.
4. A list of (no more than 6) organizations where the contractor has conducted confined space operations within the last 3 years. Contact information should be provided so these references can be checked.
5. OSHA 200 log for the last 3 years and reports on any significant accidents relating to confined space operations.
6. A statement indicating that the contractor has never been cited by SC LLR or federal OSHA or other safety compliance agencies for any confined space safety violation. If the contractor has been cited within the last 3 years, a copy of the citation and a statement from the contractor explaining the corrective actions they have implemented must be provided.
7. A statement from the contractor that all of the above is true and correct.

B. CONTRACTOR SELECTION: Once a qualified contractor has been selected, an agreement will be formalized. In this agreement it should be made clear that the contractor:

1. Must adhere to the OGS Confined Space Program even if they are more restrictive than SC OSHA standards.

2. Is required to handle safety issues involving the contractor's own employees. This includes providing them with necessary safety equipment, supplies and training.

3. Must coordinate joint-entry operations involving OGS and contractor employees.

C. OGS-Safety Support Unit will provide the following information to the contractor after selection:

1. Confined Space Program.

2. Specific entry procedures, Material Safety Data Sheets for hazardous chemicals, and Lockout/Tagout procedures, if any, for the confined space. (Known atmospheric and physical hazards, and job requirements are to be included in the Request For Proposal).

3. A statement signed by the contractor stating the contractor has received and understands the above information.

D. PLANNING: Effective planning will minimize the amount (number and duration) of exposure to and eliminate, or at least mitigate, confined space hazards. At the beginning of the project, a brief meeting between appropriate OGS and contractor personnel should be conducted to clarify that all essential information has been exchanged and that everyone is clear about their roles and responsibilities. This is especially important if the project will involve joint operations.

1. The contractor shall provide a project supervisor, safety manager and entry supervisor.

2. OGS will provide a representative from the Safety Support Unit, an area supervisor (responsible for the work site) and an entry supervisor (if there is to be a joint operation).

E. MONITORING:

1. On the first day, the OGS area supervisor should inspect the job site with the contractor and discuss safety issues.

2. The OGS area supervisor should frequently visit the job site and/or the contract supervisor to monitor the job's progress, however, the contractor will determine timing for actual site visits. Observations should include checking for atmospheric testing, ventilation, isolation/LOTO, hazard control, communications, personal protective equipment, and lighting. Discrepancies should be addressed with the contractor.

3. The contractor should notify the OGS area supervisor or Safety Support of any unplanned hazards or problems while working in the confined space. If a problem does arise, OGS should immediately stop the job. Before work progresses, the problem must first be analyzed and corrected.

F. WORK COMPLETION: After the job is finished, the contractor should review safety issues with the OGS area supervisor and Safety Support. Any difficulties should be documented and kept on file in the Safety Support Unit.